CLAIMS

What is claimed is:

1. A proportional pressure control valve for installation within a fluid system, the valve comprising when installed within the system:

a cage which extends in an axial direction and in a radial direction and includes a wall having an inner surface and an outer surface which define a thickness dimension therebetween, and the wall having formed therethrough a pump port opening in fluid communication with a pump port of the system for receiving fluid under pressure, a clutch port opening in fluid communication with a clutch port of the system for supplying such fluid to an actuator, and a tank port opening in fluid communication with a tank port of the system for returning such fluid to a tank;

a spool received within the cage to be moveable axially relative to the cage for controlling fluid flow between the clutch port opening and the pump and tank port openings, the spool having a feedback pressure surface responsive to an applied feedback fluid pressure urging the spool to move axially relative to the cage in a first direction towards a first position allowing fluid flow between the clutch port and the tank port;

a feedback pressure chamber defined within the cage for developing the feedback fluid pressure on the feedback pressure surface of the spool; and

a clutch port pressure feedback passage coupling the clutch port in fluid communication with the feedback pressure chamber for admitting a fluid flow from the clutch port into the feedback pressure chamber to develop the feedback fluid pressure on the feedback pressure surface of the spool, the clutch port pressure feedback passage being formed within the thickness dimension of the cage wall to extend generally axially intermediate a first port in fluid communication with the control pressure chamber and a second port in fluid communication with the clutch port of the system.

2. The control valve of claim 1 wherein the spool further has a control pressure surface responsive to an applied control fluid pressure urging the spool to move axially

relative to the cage in a second direction generally opposite the first direction towards a second position allowing fluid flow between the pump port and the clutch port.

3. The control valve of claim 2 wherein:

the spool further has a supply passage formed therein for receiving a fluid flow from the pump port opening of the cage; and

a control pressure chamber is defined within the cage for receiving the fluid flow from the supply passage to develop the control fluid pressure on the control pressure surface of the spool.

4. The control valve of claim 3 wherein the control pressure chamber has an outlet passage, and wherein the control valve further comprises a pilot valve for controlling fluid flow through the control pressure chamber outlet passage to regulate the control fluid pressure developed in the control pressure chamber.

5. The control valve of claim 1 wherein the first port opens generally radially into the feedback pressure chamber through the inner surface of the cage.

6. The control valve of claim 1 wherein the second port opens generally radially into the system clutch port through the outer surface of the cage.

7. The control valve of claim 1 wherein the second port is configured as a feedback restriction orifice for restricting the rate at which fluid may flow between the clutch port and the feedback pressure chamber.

8. A proportional pressure control valve installed within a fluid system comprising:

a cage which extends in an axial direction and in a radial direction and includes a wall having an inner surface and an outer surface which define a thickness dimension therebetween, and the wall having formed therethrough a pump port opening in fluid communication with a pump port of the system for receiving fluid under pressure, a clutch

port opening in fluid communication with a clutch port of the system for supplying such fluid to an actuator, and a tank port opening in fluid communication with a tank port of the system for returning such fluid to a tank;

a spool received within the cage to be moveable axially relative to the cage for controlling fluid flow between the clutch port opening and the pump and tank port openings, the spool having an inner surface and an outer surface which define a thickness dimension therebetween, and a feedback pressure surface responsive to an applied feedback fluid pressure urging the spool to move axially relative to the cage in a first direction towards a first position allowing fluid flow between the clutch port and the tank port;

a feedback pressure chamber defined within the cage for developing the feedback fluid pressure on the feedback pressure surface of the spool; and

a clutch port pressure feedback passage coupling the clutch port in fluid communication with the feedback pressure chamber for admitting a fluid flow from the clutch port into the feedback pressure chamber to develop the feedback fluid pressure on the feedback pressure surface of the spool, the clutch port pressure feedback passage being formed within the thickness dimension of the cage wall to extend generally axially intermediate a first port in fluid communication with the control pressure chamber and a second port in fluid communication with the clutch port of the system.

9. The control valve of claim 8 wherein the spool further has a control pressure surface responsive to an applied control fluid pressure urging the spool to move axially relative to the cage in a second direction generally opposite the first direction towards a second position allowing fluid flow between the pump port and the clutch port.

10. The control valve of claim 9 wherein:

the spool further has a supply passage formed therein for receiving a fluid flow from the pump port opening of the cage; and

a control pressure chamber is defined within the cage for receiving the fluid flow from the supply passage to develop the control fluid pressure on the control pressure surface of the spool.

11. The control valve of claim 10 further wherein the control pressure chamber has an outlet passage, and wherein the control valve further comprises a pilot valve for controlling fluid flow through the control pressure chamber outlet passage to regulate the control fluid pressure developed in the control pressure chamber.

12. The control valve of claim 8 wherein the first port opens generally radially into the feedback pressure chamber through the inner surface of the cage.

13. The control valve of claim 8 wherein the second port opens generally radially into the system clutch port through the outer surface of the cage.

14. The control valve of claim 8 wherein the second port is configured as a feedback restriction orifice for restricting the rate at which fluid may flow between the clutch port and the feedback pressure chamber.

15. A method of operating a proportional pressure control valve installed within a fluid system, the method comprising the steps of:

(a) providing the control valve as comprising:

a cage which extends in an axial direction and in a radial direction and includes a wall having an inner surface and an outer surface which define a thickness dimension therebetween, and the wall having therethrough a pump port opening in fluid communication with a pump port of the system, a clutch port opening in fluid communication with a clutch port of the system, and a tank port opening in fluid communication with a tank port of the system;

a spool received within the cage to be moveable axially relative to the cage for controlling fluid flow between the clutch port opening and the pump and tank port openings, the spool having an inner surface and an outer surface which define a thickness dimension therebetween, and a feedback pressure surface;

a feedback pressure chamber defined within the cage; and

a clutch port pressure feedback passage coupling the clutch port in fluid communication with the feedback pressure chamber, the clutch port pressure feedback

passage being formed within the thickness dimension of the cage wall to extend generally axially intermediate a first port in fluid communication with the control pressure chamber and a second port in fluid communication with the clutch port of the system;

(b) receiving fluid under pressure from the pump port through the pump port opening; and

(c) admitting a flow of the fluid under pressure through the a clutch port pressure feedback passage into the feedback pressure chamber to develop a feedback fluid pressure on the feedback pressure surface of the spool urging the spool to move axially relative to the cage in a first direction towards a first position allowing fluid flow between the clutch port and the tank port.

16. The method of claim 15 wherein the control valve further is provided in step (a) with the spool further having a control pressure surface, the method further comprising the step after step (b) of applying a control fluid pressure on the control pressure surface of the spool urging the spool to move axially relative to the cage in a second direction generally opposite the first direction towards a second position allowing fluid flow between the pump port and the clutch port.

17. The method of claim 16 wherein the control valve further is provided in step (a) with the spool further having a supply passage formed therein, the method further comprising the step after step (b) of receiving through the supply passage a flow of the fluid under pressure into a control pressure chamber defined within the cage to develop the control fluid pressure on the control pressure surface of the spool.

18. The method of claim 17 wherein the control valve further is provided in step (a) wherein the control pressure chamber has an outlet passage, and as further comprising a pilot valve, the method further comprising the step after step (b) of actuating the pilot valve to control fluid flow through the control pressure chamber outlet passage and thereby regulate the control fluid pressure developed in the control pressure chamber.

19. The method of claim 15 wherein the first port opens generally radially into the feedback pressure chamber through the inner surface of the cage.

20. The method of claim 15 wherein the second port opens generally radially into the system clutch port through the outer surface of the cage.

21. The method of claim 15 wherein the second port is configured as a feedback restriction orifice restricting the rate in step (c) at which the flow of the fluid under pressure is admitted though the clutch port pressure feedback passage into the feedback pressure chamber.